IBM® Technical Disclosure Bulletin Vol. 37 No. 02B February 1994

H04Q7/36

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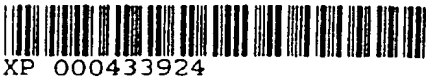
Learning about Intercell Interference Topology in a Wireless Network



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A wireless data or voice communications network of base stations and mobile devices benefits from a choice of its operating parameters that minimizes intercell interference. Disclosed is a mechanism that learns the network topology without human intervention, that topology being valuable in the choice of an interference reduction strategy.

In a wireless communications system, in which base stations are employed to provide coverage to desired areas, the location of those base stations may be difficult to determine initially and may change during the lifetime of the system. Their coverage areas may also change. Some systems require complete coverage. This implies that the coverage areas of adjacent base stations may overlap to some extent. In the region of overlap, mobile units will receive signals from both base stations, and if these signals are not separated in time, frequency, or coding, interference will result. It is the job of a distinguished station in the network, here called the "network manager," to assign time, frequencies, or codes to potentially interfering base stations so as to minimize that interference.

But expressing the adjacency between base stations may be difficult or even impossible to do manually. First of all, it is desirable to automate that task, because people make mistakes and don't want to have to express such arcane network characteristics as "adjacency." But with wireless networks, adjacency may be very hard to determine: it is well-known in radio networks, for example, that signals are guided by corridors and refracted by doorways, so the coverage area of a base station may be quite counter-intuitive. What is needed is a procedure by which the adjacency characteristic can be determined automatically.

At the time a mobile unit initiates its interaction with a wireless network, it often executes a procedure called "registration," in which it makes its presence known to a base station. During this procedure, it may listen at several times, on several frequencies, with several codes, to determine the most appropriate base station with which to associate. At registration, then, a mobile unit determines the identities of all base stations whose coverage areas overlap at its current position.

The invention consists of recording the identities of all base stations discovered at registration time, and sending this information in a message to the network manager. The network manager then fills in its data structure with this information. As other mobile units register, more such information becomes available, and the data structure becomes more complete. The data structure always reflects the most current state of adjacency, because the adjacency characteristic is dynamically determined. Deletions can be done by aging the various adjacencies. If an adjacency is not periodically confirmed it will be assumed to no longer exist. Failure of a base station will be learned by the network manager through the failure of normal, periodic exchange of status and control information.

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